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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/256,386	02/24/1999	JENS MULLER	12369US01	9751

7590

12/27/2002

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EXAMINER

YUAN, DAH WEI D

ART UNIT

PAPER NUMBER

1745

DATE MAILED: 12/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/256,386

Applicant(s)

MULLER ET AL.

Examiner

Dah-Wei D. Yuan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-15, 20-31 and 34 is/are rejected.
- 7) ☒ Claim(s) 10, 16-19, 32 and 33 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6, 7. 6) ☐ Other: .

DIRECT DIMYTHYL ETHER FUEL CELLS

Examiner: Yuan S.N. 09/256,386 Art Unit: 1745 December 10, 2002

Information Disclosure Statement

1. The information disclosure statement filed on September 7, 1999 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because translations of the French reference, 1,436,154, are not provided. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 C(1).

2. The information disclosure statement filed on June 17, 1999 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the foreign patents and non-patent literature referred to therein has not been considered.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

4. Claims 1-5,12,14,22-25,28 are rejected under 35 U.S.C. 102(e) as being anticipated by Tillmetz et al. (US 6,410,175 B1).

With respect to claims 1,22, Tillmetz et al. teach a fuel cell operated by direct oxidation of a fuel including methanol and dimethyl ether, i.e., unreformed fuel is first directed to the fuel cell stack from fuel supply. The method of operating the fuel cell is also taught. With respect to claims 3,23, the fuel cell is a solid polymer fuel cell, i.e., a proton exchange membrane fuel cell. With respect to claim 2, the operation temperature of such fuel cell is relatively low ($\sim 80^{\circ}\text{C}$). With respect to claim 4,5,24,25, fuels, including methanol and dimethyl ether, can be delivered to the fuel cell anode where they are oxidized to produce protons. Typically, aqueous liquid streams are used. With respect to claim 12, the oxidant stream is typically oxygen, delivered in a substantially pure oxygen stream or in a dilute oxygen stream such as air. The ambient pressure of air is less than 3 bar absolute, which is equivalent to 2.96 atm. With respect to claim 14, the unreformed fuel is first directed to the fuel cell stack from fuel supply during a start-up period. Therefore, the current density in the start-up stage is minimal and less than about 300 mA/cm^2 . With respect to claim 28, during operation, the fluid stream is provided by the controlled mixing of methanol (fuel) from methanol reservoir (14), which is fluidly connected to the anode in the fuel cell. See Column 1, Lines 5-8, 28-48; Column 3, Lines 41-45; Column 5, Line 66 to Column 6, line 1.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 6,9,13,20,21,29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tillmetz (US 6,410,175).

As discussed in Paragraph 4, Tillmetz et al. disclose Applicant's invention essentially as claimed, with the exceptions that the water content in the liquid fuel stream, the stoichiometry of the oxidant stream, and variations in the composition of the fuel stream are not discussed.

However, Tillmetz et al. recognize the fuel cell can be operated on fuel/water solution that have fuel concentrations in the range of from about 1 to 13% by weight and oxidant stream as a dilute oxygen stream. See Column 1, Lines 37-40; Column 6, Lines 30-33. Therefore, it would have been within the skill of the ordinary artisan to adjust the water content in the fuel stream and the oxygen content in the oxidant stream depending on the performance requirements of the fuel cell system. Where the general conditions of a claim are disclosed in the prior art it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Boesch, CCPA 1980, 617 F.2d 272, 205 USPQ215.

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7. Claims 7,8,26,27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tillmetz (US 6,410,175).

Tillmetz et al. discloses a direct oxidation fuel cell that can be operated by an aqueous methanol mixture or an aqueous dimethyl ether mixtures as discussed in Paragraph 4 above. However, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the two solutions and use them as the fuel for a fuel cell system. It is prima facie obvious to combine two compositions, each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose. In re Kerkhoven, 205 USPQ 1069, 1072.

8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tillmetz et al. (US 6,410,175) as applied to claims 1-5,12,14,22-25,28 above, and further in view of Narayanan et al. (US 6,299,744).

Tillmetz et al. disclose a method of operating a dimethyl ether fuel cell system as described above in Paragraph 4. However, Tillmetz et al. do not disclose the use of a platinum-ruthenium alloy catalyst on the anode. Narayanan et al. teach the use of a platinum-ruthenium catalyst on the anode of a direct methanol fuel cell so that the only by-product of the electro-oxidation of the fuel is carbon dioxide. See Column 5, Lines 28-49; Column 9, Lines 61-65. Therefore, it would have been within the skill of the ordinary artisan to use a platinum-ruthenium catalyst on the anode of Tillmetz, because Narayanan et al. teach the use of such catalyst can be environmentally friendly.

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9. Claims 15,30,31,34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tillmetz et al. (US 6,410,175) as applied to claims 1-5,12,14,22-25,28 above, and further in view of Prakash et al. (US 6,444,343).

Tillmetz et al. disclose a method of operating a dimethyl ether fuel cell system as described above in Paragraph 4. However, Tillmetz et al. do not disclose the inclusion of a recirculation loop fluidly connecting an electrode exhaust to a mixing apparatus. Prakash et al. teach a polymer electrolyte fuel cell using liquid organic fuel. The liquid fuel can be recycled through the anode exhaust outlet (23) to the methanol tank (19) and methanol/water pump (23). See Column 4, Lines 48-68; Column 5, Lines 44-51; Figure 1. With regard to claim 31, the methanol/water pump is considered to be a heat exchanger because it can thermally interact with the ambient. Therefore, it would have been within the skill of the ordinary artisan to add a recirculation loop on the fuel cell of Tillmetz, because Prakash teach the use of a recirculation loop in the fuel cell can be efficient in reducing the waste.

Allowable Subject Matter

10. Claims 10,16-19,32,33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 10 would be allowable because the prior does not disclose or suggest the fuel stream is supplied to the anode at a pressure greater than about 4 bar absolute. Claims 16,18,33 would be allowable because the prior art does not disclose or suggest the recirculation of dimethyl ether from cathode exhaust into the fuel stream. Claims 17,32

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would be allowable because the prior art does not disclose or suggest the use of pressure swing absorption, water absorption, or membrane separation apparatus in the recirculation loop. Claim 19 would be allowable because the prior art does not disclose or suggest to introduce dimethyl ether into the cathode before shut down of the fuel cell.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dah-Wei D. Yuan whose telephone number is (703) 308-0766. The examiner can normally be reached on Monday-Friday (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (703) 308-2383. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Dah-Wei D. Yuan
December 20, 2002


Patrick Ryan
Supervisory Patent Examiner
Technology Center 1700